

## FROM THE STREETS TO THE ED: PEDIATRIC CASE REVIEWS

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## Disclosures

- I have no actual or potential conflict of interest in relation to this program.
- I also assume responsibility for ensuring the scientific validity, objectivity, and completeness of the content of my presentation.




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## Case: 3-year old "Seizure"

### Seizure management

- How many of you would immediately treat this patient with benzodiazepines according to your protocols?




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## Case: 3 year old boy - "Seizure"

- 3 year old boy seizing for 5 min PTA
- No signs of trauma; History of seizures
- Weight 11 kg; Purple on the Broselow Tape
- PMC – Harbor-UCLA Medical Center 14 minutes




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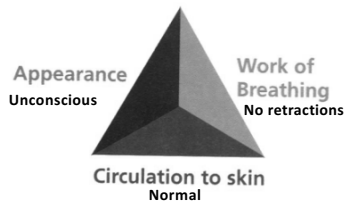
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## Pediatric Assessment Triangle



VS: Good cap refill; RR 18; 11 kg - Purple




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## Case 3 year old boy - "Seizure"

- *What is your general impression?*




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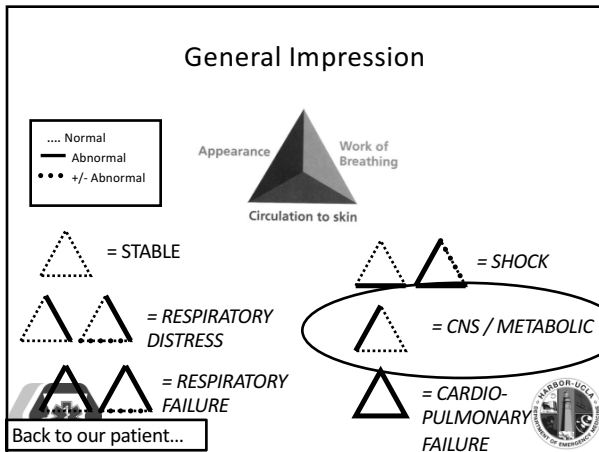
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*What are prehospital management priorities in this case?*

- Open the airway – jaw thrust
- Place on cardiorespiratory monitor
- Stop seizure with midazolam IN/IM/IV/Buccal?
- Obtain vascular access – en route (IV/IO/none?)
- Obtain rapid glucose if persistent ALOC; treat hypoglycemia if present
- Transport to pediatric receiving facility
- Document scene and patient's physical findings




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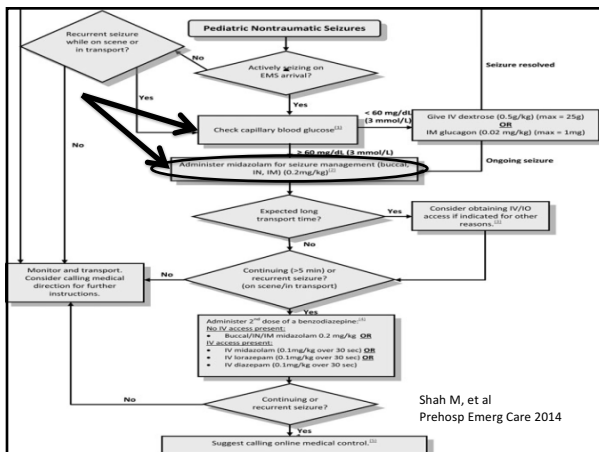
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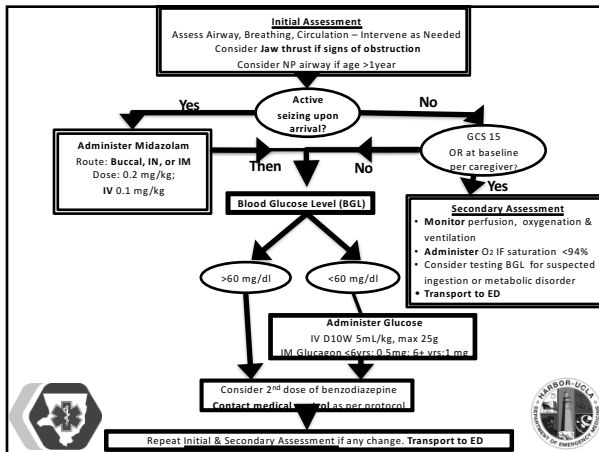
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### Case: 3 year-old boy - “Seizure”

#### Case development:

Patient received 1.1 mg IV midazolam  
Patient stopped seizing  
Patient stopped breathing

*What do you do now?*




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### Case: 3 year-old boy – “Seizure”

- Position the head
- Open the airway – jaw thrust
- Begin bag-mask ventilation (BMV) using – “squeeze, release, release” method
- Reassess clinical status
- Rapid transport




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## Hot Issues

- *What are options to manage the airway of a child in the field?*
  - BMV
  - ETI
  - Extra-glottic device




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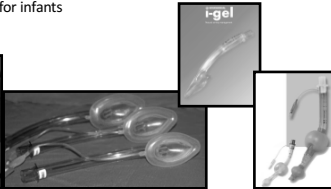
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## Airway Management Controversies

- BMV with or without airway adjunct – a staple
- ETI – no data that supports improved outcomes and concern with complications (e.g., hypoxia, dislodgement, increase in ICP, aspiration) (Gausche, et al: JAMA 2000)
- Extraglottic devices? Concern when patient regains consciousness
  - Laryngeal mask airway – not yet in scope of paramedics in most systems in USA
  - I-gel – not field tested but has all sizes and may be an alternative
  - King LTD – size NOW available for infants




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## Cricoid Pressure

- Too much cricoid pressure may lead to airway obstruction
- If no chest rise with BMV – lighten cricoid pressure
- AHA 2015 Guidelines de-emphasize use of cricoid pressure

*Why did this child stop breathing?*




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### Why did this child stop breathing?

- Tongue in children relatively large and intraoral – most common cause of airway obstruction
  - Positioning with jaw thrust may relieve obstruction
- High metabolic rate and low oxygen reserves can result in hypoxia after a brief apneic period
  - Begin bag-mask ventilation with 100% oxygen
  - May take a minute for oxygen saturations to rise
- Benzodiazepines may cause respiratory depression in children
  - Unclear true rate of respiratory depression reports 1-32% of patients in the field




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### Bosson N, et al: *Ann Emerg Med*, 2014

- **Risk Factors for Apnea in Pediatric Patients Transported by Paramedics for Out-of-Hospital Seizure**
  - Study to quantify the risk of apnea attributable to midazolam and identify additional risk factors for apnea in children transported by paramedics for out-of-hospital seizure.
  - 2 year retrospective study of 1584 children (0-15 years) with seizure transported to two peds EDs, California.
  - Median age of 2.3 years (IQR 1.4-5.2); 55% were male.
  - Paramedics treated 214 patients (13%) with midazolam.




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### Bosson N, et al: *Ann Emerg Med*, 2014

- 71 had apnea (4.5%); 44 patients were treated with midazolam and 27 patients were not treated with field medications.
  - Overall 20% of patients receiving midazolam had an apneic event.
- Using multivariate logistic regression: 2 independent risk factors for apnea were identified: persistent seizure on arrival (OR = 15 [95%CI 8-27]) and administration of field midazolam (OR = 4 [95%CI 2-7]).
- **Conclusion:** We identified 2 risk factors for apnea in children transported for seizure: **seizure on arrival to the PED** and out-of-hospital **administration of midazolam**.




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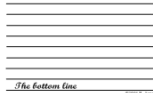
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## The Bottom Line

- Seizure is a common chief complaint in the field.
- Use of benzodiazepines may result in hypoventilation but important to stop seizure.
- Treat the seizure as prolonged seizure greater risk factor for apnea in children (IN or IM preferred as faster administration times).
- Glucose check performed on those with seizure or persistent ALOC.




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## Case: 12 month-old boy - "Choked"

- 12 month-old boy – 10 kg – Purple
- Babysitter stated that the boy ate something off the floor; white and hard; now drooling; coughing and crying




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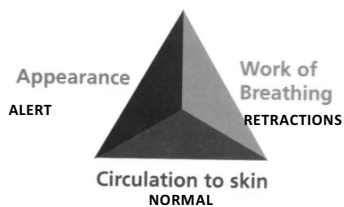
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## Pediatric Assessment Triangle



VS: HR 140; O<sub>2</sub> sat 96%; 10 kg - Purple




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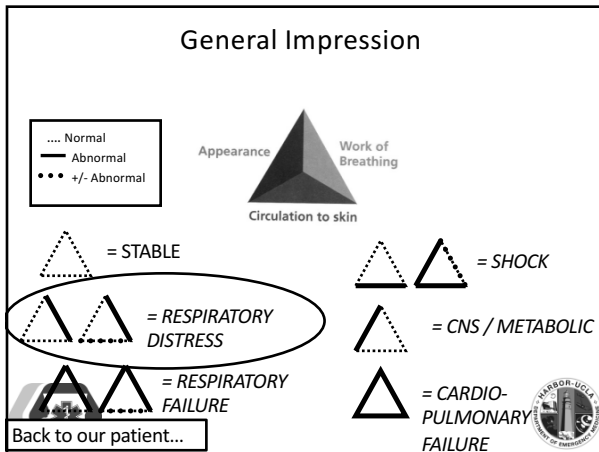
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**12 month-old boy: “Choked”**

- *What is your general impression?*
  - Respiratory distress - Foreign body aspiration
- *What are prehospital management priorities?*
  - Assess pulse oximetry reading
  - 15L oxygen by mask
  - Albuterol (?)
  - Transport

Where is the foreign body?

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**Case: 12 month-old boy - “Choked”**

- Foreign body could be in esophagus (drooling) or in lower airway (wheezes on right; clear on the left)
- This child is critically ill/injured – requires subspecialty care
  - Complications include infection, bronchospasm, and respiratory failure – rarely erosion of FB into a blood vessel and exsanguination

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## What Happened?

- Patient taken to the operating room and a round hard candy was removed from his lower airway




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## Case: 18 month-old boy - “Choked”

- 18 month-old male – 11 kg – Purple
- Eating chicken and choked
- Baby carried out to paramedics




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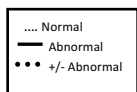
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## General Impression



= STABLE

= RESPIRATORY DISTRESS

= RESPIRATORY FAILURE

Back to our patient...

= SHOCK

= CNS / METABOLIC

= CARDIO-PULMONARY FAILURE




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## Case: 18 month-old boy - "Choked"

- *What is your general impression?*
  - Respiratory failure - Foreign body aspiration




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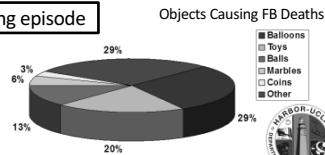
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## Foreign Body Aspiration

- >90% of deaths from FB aspiration occur in children < 5 years of age
- Liquids most common substance to cause choking
- Balloons, small objects, and food are most likely FB to cause airway obstruction

~90% will give history of choking episode




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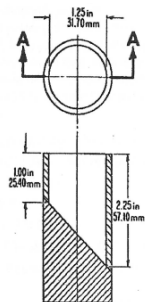
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## Consumer Safety Commission

- Small parts test fixture
- Children <3 years of age
- Many items including balloons are excluded



Small Parts Test Fixture




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## Foreign Body Aspiration

- *Signs and symptoms:*
  - Upper airway: stridor, apnea; cardiopulmonary arrest
  - Lower airway: choking, coughing, wheezing (unilateral), pneumonia

Where is the foreign body?




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## Foreign Body Aspiration

- FB likely in upper airway
  - *Prehospital Management:*
    - Alert and breathing: position of comfort and transport; oxygen as needed




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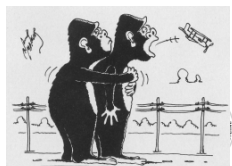
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## BLS: Foreign Body Management

- Infants
  - Back blows and chest thrusts
- Child > 1 year
  - Heimlich maneuver/ abdominal thrusts (conscious)
  - Chest compressions (unconscious)




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## ALS: Foreign Body Management

- Pediatric Magill Forceps under direct visualization
- Remember FBs may not resemble what you expect them to look like (e.g., superball)
  - If it does not look like it belongs there remove it.
  - You will not remove the patient's tonsils!




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## Case: 18 month-old boy - "Choked"

- What Happened?
  - Continued BMV in ED - pulse oximetry 90%
  - Taken to operating room where a chicken nugget was removed from upper airway
  - Child did well discharged next day




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## Bottom Line

- FB aspiration is a life threatening condition even if child appears well in the field
- Prehospital management is centered around keeping **airway open or removing FB and transport to ED**
- Remember anatomy – FB can be in esophagus, or upper/lower airway and compress the trachea leading to respiratory distress/failure




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### Case: 5 year old male with SOB

- 5 year old male (60 lbs (ugh)) at home SOB; history of asthma
- Respiratory distress stridor; seal like cough
- Pulse ox on room air 60-70%
- Pulse rate 135; BP 132/P; RR 30
- Nebulized epinephrine 5 mg/5 ml inhaled by mask
- ETA 6 min
- 15 L oxygen – Pulse ox 90% range




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### Case: 5 year old male with SOB

- Differential for stridor?
- Croup
- FB aspiration
- Anaphylaxis
- Other congenital conditions




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### Case: 5 year old male with SOB

- Croup treatment considerations
- Cool mist – gives parents something to do
- Epinephrine – works – may prevent respiratory failure
  - Field use Epi 1 mg/1mL solution HHN (2.5 mL until age 5 then 5 mL at 5 and older)
- In the ED: Corticosteroids
  - Dexamethasone (0.15-0.6 mg/kg) better than prednisolone (in ED)




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## Compression to Ventilation

- Infants and Children:
  - **NEW 2015 Conventional CPR (chest compressions and rescue breaths) should be provided for pediatric cardiac arrests.**
  - Health care providers – if alone 30:2; otherwise compression to ventilation rate 15:2
  - “Push hard, push fast” – compress chest in infant 1.5 inches (4 cm) and 2 inches (5 cm) in children – allow chest to recoil (DO NOT LEAN) – compress at 100-120/min
  - Breaths 8-10/min – **avoid excessive ventilation**
  - Switch rescuers every 2 min to avoid fatigue when doing chest compressions



Consider technique - squeeze bag just until chest rise initiated and then release  
Time ventilations by saying “squeeze, release, release”




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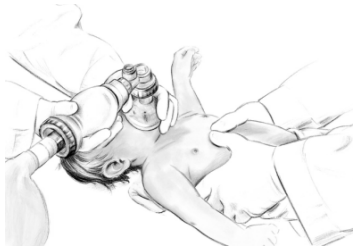
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## Two thumb-encircling hands chest compression in newborns and infants (PREFERRED 2015)



Berg MD et al. Circulation 2010;122:S862-S875

American Heart Association  
Learn and Live




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## Automated External Defibrillator (AED)

- AED – OK for infants < 1 year (preference Manual defibrillator – followed by AED with dose attenuator – followed by AED without dose attenuator) (Class IIb, LOE C).
- Recent review suggest adult AED safe to use in infants (*Pediatr Emerg Care* 2015)




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## Minute Ventilation

- Avoid excessive ventilation of infants and children during resuscitation from cardiac arrest; insufficient data to identify optimal tidal volume or rate
  - Animal studies show excessive ventilation decreases cerebral perfusion pressure, ROSC and survival
  - Excessive ventilation increases intrathoracic pressure impedes venous return, reduces CO and cerebral and coronary blood flow
  - During CPR ventilate 8-10 times per minute for infants and children



**DON'T BAG TOO FAST!!! Say "Squeeze, release release"**




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## In the ED: Cuffed vs Uncuffed Endotracheal Tubes

- Will the cuff cause pressure on the cricoid cartilage leading to pressure necrosis?
- Short answer....NO

Weiss M, et al: *Br J Anesthes* 2009  
2246 children RCT (1119/1127  
cuffed/uncuffed)

Post-extubation stridor was noted in 4.4% of patients with cuffed and in 4.7% with uncuffed TTs (P=0.543).

TT exchange rate was 2.1% in the cuffed and 30.8% in the uncuffed groups (P<0.0001).




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## In The ED: Cuffed vs Uncuffed ETT

- <1 year
  - Uncuffed 3.5 mm ID; Cuffed 3.0 mm ID
- 1-2 years
  - Uncuffed 4.0 mm ID; Cuffed 3.5 mm tube
- >2 years:
  - Uncuffed (age (yrs)/4) + 4 = mm ID
  - Cuffed (age (yrs)/4) + 3.5 = mm ID

- What I do is determine standard uncuffed size then use ½ size smaller...




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## Quick Calculation

Age (years)	Weight (kg)	ETT Uncuffed/Cuffed
1	10	4.0 mm / 3.5 mm
5	20	5.0 mm/ 4.5 mm
8-10	30	6.0 mm cuffed




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## In the ED: Atropine

- There is no evidence to support the *routine* use of atropine as a premedication to prevent bradycardia in emergency pediatric intubations.
- There is no evidence to support a minimum dose of atropine when used as a premedication for emergency intubation – dose by weight at 0.02 mg/kg




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## In the ED: Sedatives for RSI

Medication	Dose	Indication
Etomidate	0.3 mg/kg	Head trauma, hypotension not due to sepsis
Fentanyl	2-10 mcg/kg	Head trauma, avoid high doses
Ketamine	1-2 mg/kg	Hypotension from any cause, reactive airway disease
Midazolam	0.1-0.4 mg/kg	Status, respiratory failure without hypotension

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## In the ED: Other issues with RSI

- Paralytic depends on your practice either rocuronium or succinylcholine OK
- Preoxygenate with 100% oxygen – use high flow nasal cannula during apneic period (5-15 L/min)
- If in shock do your best to give fluids prior to paralysis – push pull technique or give saline flushes to rapidly infuse prior to intubation




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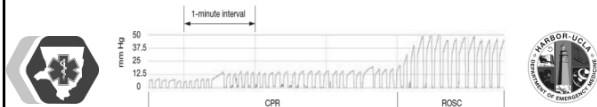
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## Endtidal CO<sub>2</sub>

- Capnography is recommended to confirm ETT placement and assess adequacy and success of CPR (Class IIa, LOE C)
- Post-ROSC ventilation strategies in children should target a PaCO<sub>2</sub> that is appropriate for each patient while avoiding extremes of hypercapnia or hypocapnia.




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## Oxygen



- After ROSC in children, it may be reasonable for rescuers to titrate oxygen administration to achieve normoxemia (oxyhemoglobin saturation of 94% or above).
- Oxygen should be weaned to target an oxyhemoglobin saturation within the range of 94% to 99%.
- The goal should be to strictly avoid hypoxemia while maintaining normal oxygenation.




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### Length-based resuscitation Tape

- Regardless of the patient's habitus, use the actual body weight for calculating initial resuscitation
- If the child's weight is unknown, it is reasonable to use a body length tape with precalculated doses (Class IIa, LOE C)

BLUE			
Sedation		Pain	
Concentration	2 mg	Midazolam (Versed)	0.2 mg/kg
Concentration	4.2 mg	Concentration (100 mg in 100 mL)	420 mg
Concentration	15 mg	Concentration	150 mg
Phenobarbital Load	400 mg	Midazolam	0.2 mg/kg
Phenobarbital Load	200 mg	Concentration	100 mg
Pain			
Concentration	10.0 mg	10.0 mg/kg	10.0 mg/kg
Concentration	2.0 mg	2.0 mg/kg	2.0 mg/kg
Concentration	1.0 mg	1.0 mg/kg	1.0 mg/kg
Concentration	0.5 mg	0.5 mg/kg	0.5 mg/kg
Concentration	0.25 mg	0.25 mg/kg	0.25 mg/kg
Concentration	0.125 mg	0.125 mg/kg	0.125 mg/kg
Concentration	0.0625 mg	0.0625 mg/kg	0.0625 mg/kg
Concentration	0.03125 mg	0.03125 mg/kg	0.03125 mg/kg
Concentration	0.015625 mg	0.015625 mg/kg	0.015625 mg/kg
Concentration	0.0078125 mg	0.0078125 mg/kg	0.0078125 mg/kg
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Concentration	0.00048828125 mg	0.00048828125 mg/kg	0.00048828125 mg/kg
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Concentration	0.00000000000005684341886080767736968994140625 mg	0.00000000000005684341886080767736968994140625 mg/kg	0.00000000000005684341886080767736968994140625 mg/kg
Concentration	0.000000000000028421709430403838684844970703125 mg	0.000000000000028421709430403838684844970703125 mg/kg	0.000000000000028421709430403838684844970703125 mg/kg
Concentration	0.0000000000000142108547152019193424224853515625 mg	0.0000000000000142108547152019193424224853515625 mg/kg	0.0000000000000142108547152019193424224853515625 mg/kg
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Concentration	0.0000000000000035527136788004798356056221337890625 mg	0.0000000000000035527136788004798356056221337890625 mg/kg	0.0000000000000035527136788004798356056221337890625 mg/kg
Concentration	0.0000000000000017763568394002399178028111059453125 mg	0.0000000000000017763568394002399178028111059453125 mg/kg	0.0000000000000017763568394002399178028111059453125 mg/kg
Concentration	0.00000000000000088817841970011995890140555297265625 mg	0.00000000000000088817841970011995890140555297265625 mg/kg	0.00000000000000088817841970011995890140555297265625 mg/kg
Concentration	0.00000000000000044408920985005997945070277648828125 mg	0.00000000000000044408920985005997945070277648828125 mg/kg	0.00000000000000044408920985005997945070277648828125 mg/kg
Concentration	0.000000000000000222044604925029989725351388244140625 mg	0.000000000000000222044604925029989725351388244140625 mg/kg	0.000000000000000222044604925029989725351388244140625 mg/kg
Concentration	0.0000000000000001110223024625149948626756941220703125 mg	0.0000000000000001110223024625149948626756941220703125 mg/kg	0.0000000000000001110223024625149948626756941220703125 mg/kg
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Concentration	0.000000000000000000013552527156068724983822713551296532195727890625 mg	0.000000000000000000013552527156068724983822713551296532195727890625 mg/kg	0.000000000000000000013552527156068724983822713551296532195727890625 mg/kg
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**REFERENCE NO. 1309**DEPARTMENT OF HEALTH SERVICES  
COUNTY OF LOS ANGELES(PARAMEDIC/MICN)  
REFERENCE NO. 1309**MEDICAL CONTROL GUIDELINE: COLOR CODE DRUG DOSES - L.A. COUNTY KIDS****PRINCIPLES:**

1. Correct dosing of medications based on weight in kilograms is a safety concern for delivery of medications to children in the prehospital setting.
2. To optimize safety in dosing medications for children, a standard formulary has been created. This *Color Code Drug Doses L.A. County Kids* medical control guideline pre-calculates all doses based on kilogram weight in children.
3. EMS provider agencies shall procure medications and stock approved Assessment and ALS Units in accordance with the drug formulation specified in this medical control guideline.
4. The Color Code Drug Doses L.A. County Kids and the Treatment Protocols shall be used to determine drug doses.


MEDICATION	FORMULATION	DOSAGE	Maximum Pediatric Single Dose
Adenosine	12mg/4mL or 6mg/2mL	0.1mg/kg Repeat dose 0.2mg/kg	6mg 12mg
Albuterol	2.5mg/3mL	2.5mg <1yr; 5mg 1yr or older	5mg
Amiodarone	150mg/3mL	5mg/kg	300mg
Atropine	1mg/10mL	0.02mg/kg	0.5mg
Calcium Chloride	100mg/1mL	20mg/kg	1,000mg
Dextrose 10%	0.1mg/1mL	5mL/kg	250mL
Diphenhydramine	50mg/1mL	1mg/kg	50mg
Epinephrine 0.1mg/mL (IV)	0.1mg/1mL	0.01mg/kg	1mg
Epinephrine 1mg/mL (IM)	1mg/1mL	0.01mg/kg	0.5mg
Epinephrine 1mg/mL (for inhalation)	1mg/1mL	2.5mL <5yr; 5mL 5yr or older	5mL
Fentanyl IV	50mcg/1mL	1mcg/kg	50mcg
Fentanyl IN	50mcg/1mL	1.5mcg/kg	50mcg
Glucagon	1mg/1mL	0.5 mg <5yr; 1mg 5yr or older	1mg
Lidocaine (IO ONLY)	100mg/5mL	0.5 mg/kg	18mg
Midazolam	5mg/1mL	0.1mg/kg	5mg
Morphine Sulfate	4mg/1mL	0.1mg/kg	4mg
Naloxone	1mg/1mL	0.1mg/kg	2mg
Normal Saline	0.9% NaCl	20mL/kg	1,000mL
Ondansetron ODT (5yrs or older)	4mg	4mg	4mg
Sodium Bicarbonate IV (dilute 1:1 for <1yr)	1mEq/1mL	1mEq/kg	50mEq

Length 107 – 119.5 cm		5 – 6 years			
Normal Vital Signs:		Heart Rate: 70-120 Respirations: 18-30		Systolic BP: >80	
19 Kg	Cardioversion:	19 joules	38 joules	38 joules	
	Defibrillation:	38 joules	76 joules	76 joules	
	Medication	Dose	mLs	Medication	Dose
	Adenosine	1.9mg	0.63mL	Fentanyl IV/IM	19mcg
	Albuterol HHN	5mg	6mL	Fentanyl IN	28.5mcg
	Amiodarone	95mg	1.9mL	Glucagon IM	1mg
	Atropine	0.38mg	3.8mL	Lidocaine IO	9.5mg
	Calcium Chloride	380mg	3.8mL	Midazolam IV/IM/IN	1.9mg
	Dextrose 10% slow IV	95mL	95mL	Morphine Sulfate IV	1.9mg
	Diphenhydramine IV/IM	19mg	0.38mL	Naloxone IV/IM/IN	1.9mg
20 Kg	Epinephrine 0.1mg/mL IV	0.19mg	1.9mL	Normal Saline IV Bolus	380mL
	Epinephrine 1mg/mL IM	0.19mg	0.19mL	Ondansetron	4mg
	Epinephrine 1mg/mL HHN	5mg	5mL	Sodium Bicarbonate	19mEq
	Cardioversion:	20 joules	40 joules	40 joules	
	Defibrillation:	40 joules	80 joules	80 joules	
	Medication	Dose	mLs	Medication	Dose
	Adenosine	2mg	0.66mL	Fentanyl IV/IM	20mcg
	Albuterol HHN	5mg	6mL	Fentanyl IN	30mcg
	Amiodarone	100mg	2mL	Glucagon IM	1mg
	Atropine	0.4mg	4mL	Lidocaine IO	10mg
	Calcium Chloride	400mg	4mL	Midazolam IV/IM/IN	2mg

## Bottom Line with Medications Be Organized and Avoid Calculation in Crisis



**Resuscitation and Emergency Infusions**



**15 kg 20 kg 25 kg 30 kg**

length 107–118.5 cm

weight 18.5–25 kg

height 107–118.5 cm

weight 18.5–25 kg

5–6 years

weight 18.5–25 kg

height 107–118.5 cm

weight 18.5–25 kg

Medication	15 kg	20 kg	25 kg	30 kg
Adrenaline	0.1 mg	0.2 mg	0.3 mg	0.4 mg
Atropine	2 mg	4 mg	6 mg	8 mg
Epinephrine	0.1 mg	0.2 mg	0.3 mg	0.4 mg
Flumazenil	2 mg	4 mg	6 mg	8 mg
Fentanyl	0.1 mg	0.2 mg	0.3 mg	0.4 mg
Midazolam	0.5 mg	1 mg	1.5 mg	2 mg
Propofol	0.5 mg	1 mg	1.5 mg	2 mg
Rosuvastatin	0.5 mg	1 mg	1.5 mg	2 mg
Succinylcholine	0.5 mg	1 mg	1.5 mg	2 mg
Thiopental	0.5 mg	1 mg	1.5 mg	2 mg
Valproic acid	0.5 mg	1 mg	1.5 mg	2 mg
Verapamil	0.5 mg	1 mg	1.5 mg	2 mg
Vincristine	0.5 mg	1 mg	1.5 mg	2 mg
Vitamin K	0.5 mg	1 mg	1.5 mg	2 mg
Warfarin	0.5 mg	1 mg	1.5 mg	2 mg

DEPARTMENT OF HEALTH SERVICES  
COUNTY OF LOS ANGELES

**MEDICAL CONTROL GUIDELINE: COLOR CODE DRUG DOSES - L.A. COUNTY KIDS**

(PDA/MEDICATION)  
REFERENCE NO. 1309

**PRINCIPLES:**

1. Careful dosing of medications based on weight in kilograms is a safety concern for delivery of medications to children in the prehospital setting.
2. To optimize safety in dosing medications for children, a standard formula has been created. This Color Code Drug Doses L.A. County Kids medical control guideline pre-calculates all doses based on kilogram weight in children.
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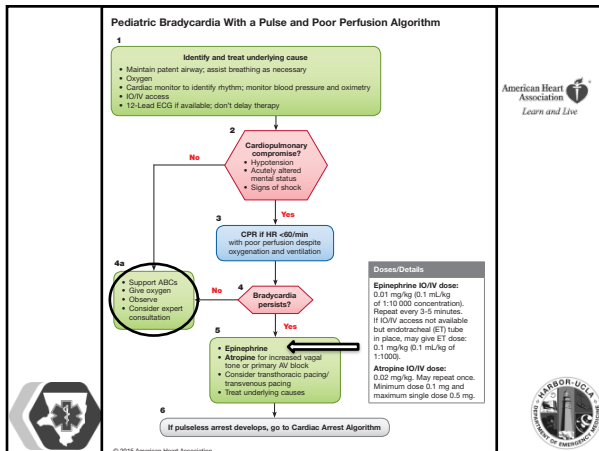
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## New Epinephrine Labeling

- Say good-bye to 1:1,000 and 1:10,000
- Now it is 1 mg/1 mL for IM dosing
- 0.1mg/mL for IV dosing




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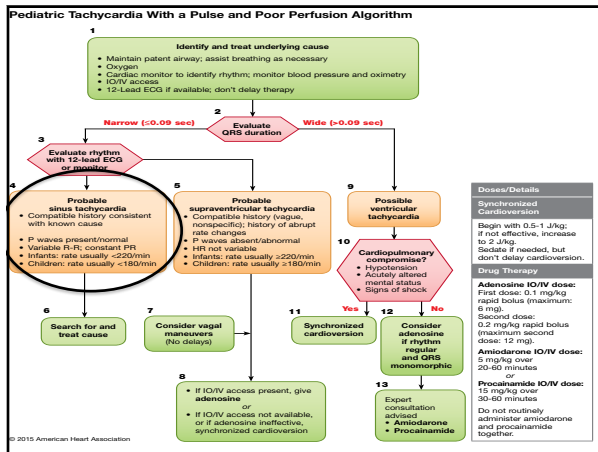
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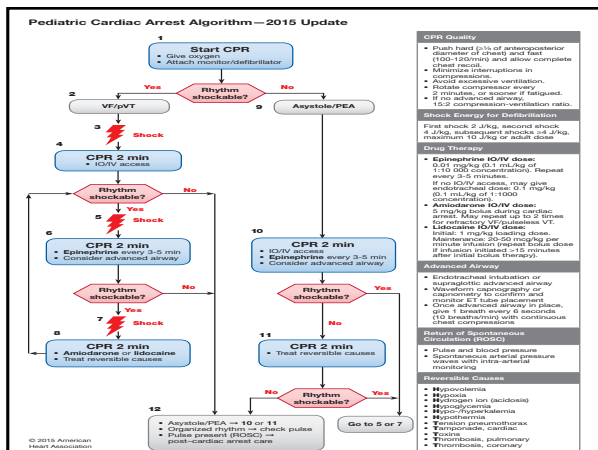
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## 17 year old male collapses

- 17 year old male playing basketball
- Sudden collapse; family did chest compressions
- No family or prior history



## Defibrillation (New 2015)

- It is reasonable to use an initial dose of 2 to 4 J/kg of monophasic or biphasic energy for defibrillation (Class IIa, LOE C-LD), but for ease of teaching, an initial dose of 2 J/kg may be considered. (Class IIb, LOE C-EO)
- For refractory VF, it is reasonable to increase the dose to 4 J/kg. (Class IIa, LOE C-LD)
- For subsequent energy levels, a dose of 4 J/kg may be reasonable and higher energy levels may be considered, though not to exceed 10 J/kg or the adult maximum dose. (Class IIb, LOE C-LD)




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## 17 year-old male S/P CPA

- Patient did well
- Survived arrest neurologically intact
- Transferred to UCLA for electrophysiologic studies – AICD placed
- Unclear cause of arrest at this point – ruled out prolonged QT
- Referred to genetics




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## Family Presence

- Family presence for resuscitations is recommended
- Numerous studies have documented that parents wish to be given option of being present during resuscitation of their children
- Develop protocol for family centered care – improves safety as well

THE NEW ENGLAND JOURNAL OF MEDICINE

ORIGINAL ARTICLE

### Family Presence during Cardiopulmonary Resuscitation

Patricia Jabre, M.D., Ph.D., Vanessa Belpomme, M.D., Elie Azoulay, M.D., Ph.D., Line Jacobs, M.D., Lionel Bertrand, M.D., Frederic Lapostolle, M.D., Ph.D., Karim Tazartout, M.D., Ph.D., Guillem Bouilleau, M.D., Virginie Pinaud, M.D., Claire Broche, M.D., Donnelle Normand, M.S., Thierry Baudet, M.D., Ph.D., Agnes Ricard-Hibon, M.D., Ph.D., Jacques Idris, M.D., Alexandra Beltrami, M.D., Amelie Albertini, M.D., Nathalie Assou, M.D., Lionel Neau, M.D., Benoit Vivien, M.D., Ph.D., Laurent Tori, M.D., Stephane Launay, M.D., Michel Desmazières, M.D., Stephen W. Borron, M.D., Eric Vicaut, M.D., Ph.D., and Frederic Adnet, M.D., Ph.D.

ABSTRACT




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## Case Presentation 2 month old

### ALTE destination

- How many of you would transport this patient to a specialized center according to your protocols?




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## Case Presentation

- EMS transports a 2 month infant with “ALTE” Apparent Life Threatening Event.
  - Weight 3 kg – Gray on Broselow
  - Born at 25 weeks – Mom fed baby then he started coughing and choking, baby went limp and turned blue
  - Mom started CPR for 2-3 minutes




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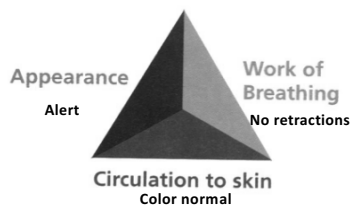
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## Pediatric Assessment Triangle



VS: HR 160; RR 24; O<sub>2</sub> sat 99%; 3 kg – Gray on Broselow Tape




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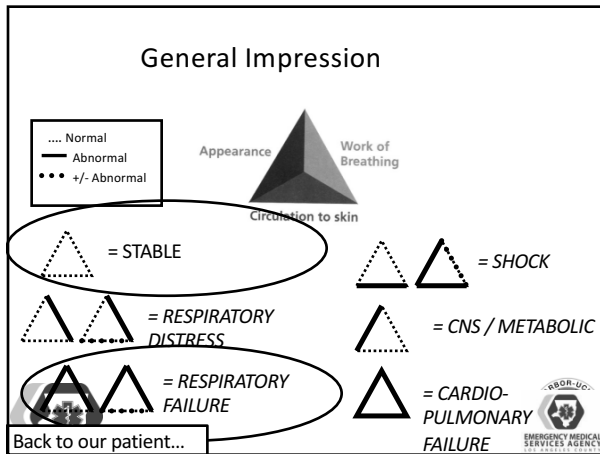
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**Case: 2 month- baby male**

- *What is your general impression?*
  - Stable at this time; history of respiratory failure (apnea) - ALTE/BRUE
- *What are prehospital management priorities?*
  - Continuous monitoring of cardiorespiratory status
  - Assess pulse oximetry reading
  - Transport

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**Hot Issues**

- *How often do infants with ALTE/BRUE have abnormal physical exam findings in the field?*
- *Do all infants and children with ALTE/BRUE require transport?*

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Stratton, et al: *Ann Emerg Med*, 2004

- Retrospective cohort of infants  $\leq 12$  months of age over 2 months in Los Angeles County, CA
  - 804 infants of which 60 (7.5%) met criteria for ALTE
  - Mean age for ALTE - 3 months
  - 83% appeared to be in no acute distress
  - 48% of these had serious/life threatening illness at ED evaluation
- Serious illness identified:
  - Anemia
  - Apnea
  - Bacterial meningitis
  - Bronchiolitis\*
  - Dehydration
  - Gastroesophageal reflux\*
  - Intracranial hemorrhage
  - Pneumonia
  - Seizure
  - Sepsis

\* Most common diagnoses




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*Do all children with ALTE require transport?*

- Yes...
- United States standard is transport yet emerging data may allow for transport to noncritical care centers




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Kaji A, et al:  
*Prehosp Emerg Care* 2013

- **Do Infants Less Than or Equal to 12 Months of Age with an Apparent Life Threatening Event (ALTE) Need Transport to a Pediatric Critical Care Center (PCC)?**
  - 513 patients with ALTE were transported by EMS to 4 PCCs; 51 (9.9%) had an intervention warranting PCC management.
  - 3 independent predictors for requiring PCC management [sensitivity of 96.3%, specificity of 25.8%, NPV of 98.3%]
    - resuscitation attempt before EMS arrival
    - cyanosis
    - greater than one ALTE in 24 hours
  - Only 9.9% of infants presenting in the field with ALTE needed PCC management, suggesting that many ALTE patients may be safely transported to hospitals without PCC capability.




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### Case: 2 month-baby male What Happened?

- Baby noted to have intermittent apnea in the ED
  - RSV infection
- Transferred to PICU
  - Intubated that eve
- Discharged 3 days later doing well




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### Definitions

- **Apparent Life Threatening Event (ALTE):** An episode that is frightening to the observer and that is characterized by some combination of apnea, color change, marked change in muscle tone, choking or gagging.




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CLINICAL PRACTICE GUIDELINE: Guidance for the Clinician in Rendering Pediatric Care

American Academy  
of Pediatrics  
DEDICATED TO THE HEALTH OF ALL CHILDREN™



### Brief Resolved Unexplained Events (Formerly Apparent Life-Threatening Events) and Evaluation of Lower-Risk Infants

Joel S. Tjebbes MD, MPH, FAAP, Joshua L. Berkowitz MD, PhD, FAAP, Ruth A. Clay MD, PhD, FAAP, Wayne H. Edwards MD, MPH, MMSc, FAAP, David A. Greenberg MD, FAAP, Bruce Herman MD, FAAP, Todd S. Katz MD, FAAP, Leonard S. Kohn MD, FAAP, J. Lawrence Morfitt MD, FAAP, Chuck Norton MD, FAAP, Jack Pappalardo MD, MPH, FAAP, Robert E. Segal MD, MMSc, FAAP, Richard W. Shusterman MD, MSc, FAAP, Michael B. Smith MD, FAAP, FAAP, for the SUBCOMMITTEE ON APPARENT LIFE THREATENING EVENTS

- **Brief Resolved Unexplained Event (BRUE):** an event occurring in an infant <1 year of age when the observer reports a sudden, brief, and now resolved episode of  $\geq 1$  of the following:

- cyanosis or pallor, absent, decreased, or irregular breathing, marked change in tone (hyper- or hypotonia), altered level of responsiveness (choking or gagging not included)




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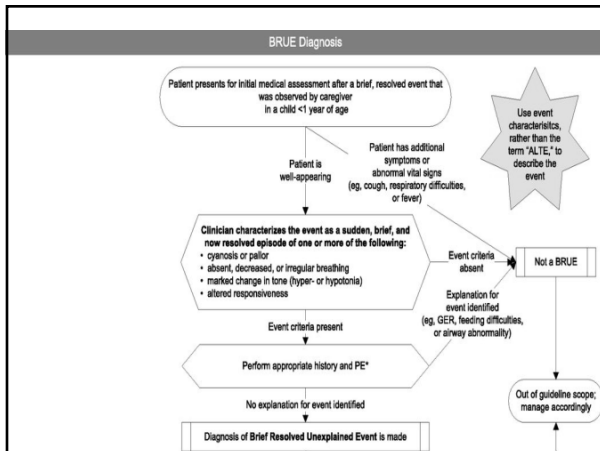
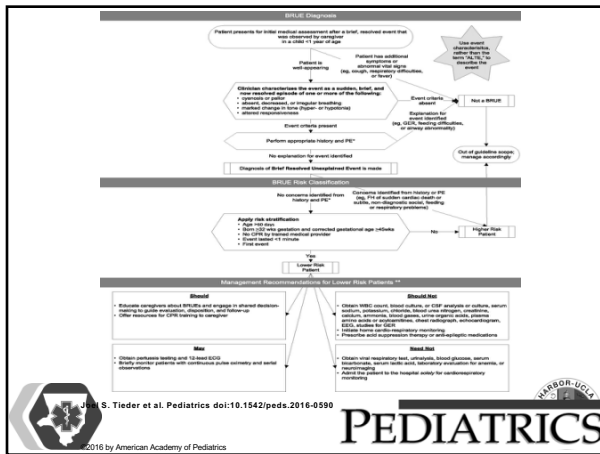
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## BRUE

- Clinicians should diagnose a BRUE only when there is no explanation for a qualifying event after conducting an appropriate history and physical examination
- Goal: to foster family-centered care, reduce unnecessary medical evaluations, improve outcomes and foster research.



BRUE		
	Includes	Excludes
Brief/resolved	<ul style="list-style-type: none"> <li>Duration &lt;1 min ; typically 20-30 secs</li> <li>Patient returns to baseline</li> <li>Normal VS and appearance</li> </ul>	<ul style="list-style-type: none"> <li>&gt;1 min</li> <li>Serious underlying symptoms, such as fever, tachycardia, ALOC, petechiae or bruising</li> <li>Repeat Events</li> </ul>
Unexplained	<ul style="list-style-type: none"> <li>No identifiable medical condition</li> </ul>	<ul style="list-style-type: none"> <li>Event consistent with GERD, child abuse, congenital conditions, infections</li> </ul>
Event with cyanosis or pallor	<ul style="list-style-type: none"> <li>Central or obstructive apnea</li> </ul>	<ul style="list-style-type: none"> <li>Periodic breathing</li> <li>Breath holding spell</li> </ul>
Marked change in tone	<ul style="list-style-type: none"> <li>Hypotonia/hypertonia</li> </ul>	<ul style="list-style-type: none"> <li>Seizure or other identifiable condition associated with tone changes</li> </ul>
Altered responsiveness	<ul style="list-style-type: none"> <li>LOC, AMS, lethargy, somnolence</li> </ul>	<ul style="list-style-type: none"> <li>LOC associated with breath holding</li> </ul>

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Keys to History	
<ul style="list-style-type: none"> <li>Sibling death/ sudden death in the family/ sibling with underlying metabolic disease</li> <li>Previous illness or exposures to illness</li> <li>Loss of milestones</li> <li>Recurrent neurological conditions</li> </ul>	<ul style="list-style-type: none"> <li>Inborn errors/prolonged QT/ child abuse</li> <li>Helps with risk assessment for infection</li> <li>Concern for tumor or degenerative conditions</li> <li>Seizures/ inborn errors</li> </ul>

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Risk Assessment with BRUE	
Patient Factors that Determine Low Risk	
<ul style="list-style-type: none"> <li>Age &gt; 60 days</li> <li>Prematurity age <math>\geq</math> 32 weeks or postconceptional age <math>\geq</math> 45 weeks</li> <li>First BRUE</li> <li>Duration &lt; 1 minute</li> <li>No CPR required by trained medical provider</li> <li>No concerning historical features</li> <li>No concerning physical findings</li> </ul>	

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## A word or two on breath holding



<http://www.youtube.com/watch?v=2bKVHSe6hVQ>




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## Breath Holding

- Occurs in 5% of otherwise healthy children
  - Usually begins in second year but not uncommon in infants
  - Disappears by age 4 in 50% of children and by age 8 in about 83% of children
  - Self-limited and benign
- The Bottom Line
  - Breath-holding especially the first episode appears frightening and may be diagnosed as ALTE
  - Obtain ECG; HgB; Reassurance




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## Hot Issues

- *What should be the extent of the work-up in the ED?*
- *Do all infants and children with ALTE/BRUE require admission and continuous monitoring?*




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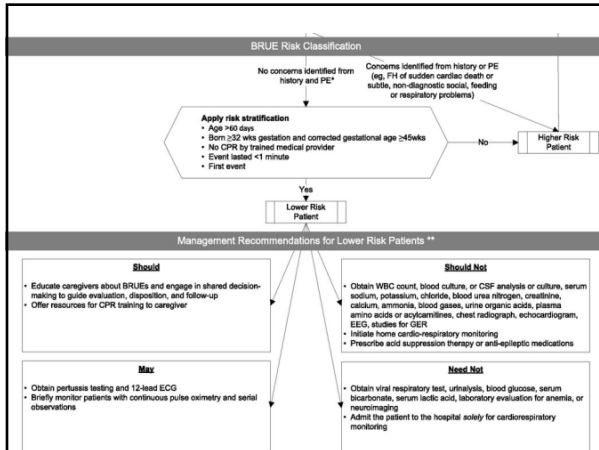
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## Emergency Department

- History:
  - Features of incident (seizure?, GERD?)
  - Associated symptoms (choking, apnea, loss of tone, change of color? URI ?, fever?)
  - Recurrent neuro syndromes with minor illness consider metabolic disease
  - Sibling death? (child abuse, inborn errors, prolonged QT)




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## Emergency Department

- Physical examination:
  - Assess vital signs including pulse oximetry
  - Cardiorespiratory monitoring
  - Perform complete physical
    - Gastric contents in nose or mouth suggests GERD
    - Wheezing or coughing suggests respiratory infection (RSV or *Bordetella pertussis*)
    - Assess for signs of child maltreatment (rare)
    - Abnormal mental status for age, decreased muscle tone, jaundice, rash, fever may be serious signs




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## ED Diagnostic Testing

- Unclear what tests are necessary...for Low risk BRUE few tests needed
- For afebrile, well appearing infant – my testing strategy...
  - ECG
- Febrile: Work-up based on age (as per SBI), risk stratification, immunization status, RSV, pertussis, blood cultures
- Ill appearing: Full septic work-up, consider head CT; lactate; ammonia; RSV, pertussis, tox screen, CO level, stool for botulinum




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## Bottom Line

- ED evaluation based on presentation in the ED
- Admission?
  - Admit those who appear ill on arrival, >1 ALTE/BRUE, or those with significant PMH
  - If low risk BRUE may D/C with close follow-up




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## Conclusions

- ALTE/BRUE has many life threatening causes
- ALTE/BRUE management based on presentation – presence of low risk features
  - In the field, transport to the ED regardless of the presentation; selective transport to pediatric critical care centers
  - In the ED, stabilize and recommend admission in recurrent ALTE/BRUE, abnormal exam on presentation, co-morbid disease or in cases where cause is known but may be progressive




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